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BY THE COMPTROLLER GENERAL

ORIGIN

Report To The Congress

OF THE UNITED STATES

COMPLETED

Controlling Federal Costs For Coal Liquefaction Program Hinges On Management And Contracting Improvements

Two pilot plants to demonstrate direct liquefaction processes for producing synthetic liquids and solids from coal became operational during 1980. The plants were financed jointly by the Federal Government and private industry. The Federal Government's share of the cost of one plant was 87 percent; on the other, costs were shared equally. Construction of two more larger facilities is scheduled to begin in 1981. Foreign government investment is high in one plant but private contractor investment is low for both.

Both operational pilot plants encountered design and construction problems attributable to DOE's premature commitment to contracting and to poor construction and contract administration by the contractors. The problems greatly increased cost and schedule slippages. Should similar problems be encountered on the planned demonstration facilities, costs to the Federal Government could be enormous.

GAO makes recommendations to DOE to control cost growth and management of future coal liquefaction and other energy projects and to enhance the prospects for successful future commercialization.

SUMMARY

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COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

CONTROLLING FEDERAL COSTS FOR COAL LIQUEFACTION PROGRAM HINGES ON MANAGEMENT AND CONTRACTING IMPROVEMENTS

D I G E S T

Coal liquefaction is the process of converting pulverized coal into synthetic fuels as a substitute for petroleum products. Four direct liquefaction processes have been developed: H-Coal, Exxon Donor Solvent, Solvent Refined Coal-I, and Solvent Refined Coal-II.

None of the processes will be commercialized until the late 1980s or thereafter. Commercial plants would be built to process between 17,000 and 30,000 tons of coal a day. Each process is expected to produce the equivalent of three barrels of liquids from a ton of coal.

The two largest existing coal liquefaction facilities (H-Coal and Exxon Donor Solvent) are classified as pilot plants. They can process between 200 to 600 tons of coal a day. Construction of these plants was completed in December 1979 and March 1980, with operations starting in 1980.

Two Solvent Refined Coal pilot plants have been operational since 1974, but they process only 6 to 50 tons a day. Two plants, classified as demonstration plants, are under design with construction to start in March 1981 and operations in October 1984. These plants will be sized to process up to 6,000 tons a day.

PROBLEMS ENCOUNTERED WITH H-COAL AND EXXON DONOR SOLVENT PILOT PLANTS

The Department of Energy's (DOE's) estimated total costs for the H-Coal and Exxon Donor Solvent pilot plants show each will exceed their baseline estimate covering research and design, plant construction, and operations by 66 and 24 percent, respectively.

The H-Coal baseline estimate was $178.8 million and is presently projected at $296.1 million. The Federal Government's share is about 87 percent of the total predicted cost. The Exxon plant baseline estimate for liquefaction was $225 million and is now projected at $279.5 million. The Federal Government's share is 50 percent. (See pp. 11 and 12.)

Both the H-Coal and Exxon projects experienced engineering cost growth in designing the plants and changes occurring during construction because of the concurrency between design and the construction work. Problems associated with H-Coal were of greater severity and magnitude. GAO believes that the problems encountered at H-Coal began when the Federal Government was unable to obtain adequate sharing of risks by private sponsors in this venture. (See pp. 13 and 14.)

DOE FAILED TO PROPERLY DEFINE AND CONTROL WORK ON THE H-COAL PROJECT

DOE contractual agreements with the prime contractors were made before the design scheme for the H-Coal plant was complete. For example, the initial construction and operations contract was signed when the design package was only 20 to 25 percent complete. As a result, the scope of work to be performed could only be general in nature and estimates had no sound basis. (See pp. 17 to 19.)

In the administration of the H-Coal contracts, GAO found that DOE:

--Delegated administration of prime contracts to other prime contractors, DOE program offices, and other Federal agencies. (See p. 20.)

--Failed to make modifications part of the contract in a timely manner. (See pp. 20 and 21.)

--Did not exercise adequate control over the construction change order system. (See pp. 21 to 23.)

--Permitted the contractor for construction to award a large number of subcontracts and to engage in unacceptable Federal subcontracting practices. (See pp. 23 and 24.)

--Did not perform timely audits of contractor cost. (See pp. 24 and 25.)

CONTRACTORS INVOLVED IN POOR AND QUESTIONABLE CONSTRUCTION PRACTICES

In the construction of the H-Coal pilot plant, several problems resulted from poor judgment and lack of management and controls over the project by DOE and contractors. Collectively, the problems substantially increased cost and schedule slippages. They included:

--Starting construction before enough of the detailed design and construction schedule were complete. (See pp. 26 and 27.)

--Low labor productivity and the need to import craft labor. (See pp. 27 and 28.)

--Improper property acquisitions and the lack of controls over such property. (See pp. 28 to 32.)

--Equipment cost not minimized. (See p. 32.)

--Inadequate quality control. (See pp. 32 and 33.)

--Excessive project overhead. (See pp. 33 and 34.)

--Building beyond the needs of the pilot plant. (See pp. 34 to 39.)

PLANS FOR SOLVENT REFINED COAL DEMONSTRATION PLANTS

DOE plans to construct two Solvent Refined Coal demonstration plants. The estimated cost of these plants has significantly increased over the original estimate of $685 million each. After preliminary design, the costs were reestimated by DOE contractors to

about $1.9 billion for Solvent Refined Coal-I and $1.4 billion for Solvent Refined Coal-II. These estimates did not contain any provision for contingencies, escalation, or potential product revenues. With contingencies and escalation included, the estimated cost is $3.1 billion for Solvent Refined Coal-I and $2.7 billion for Solvent Refined Coal-II. Presently, DOE and its contractors estimate each project at $1.4 billion. However, this takes into account potential product revenues but omits the cost of contingencies and escalation during the 5-year operations phase. GAO believes that complete cost estimates are critical to future decisions on these plants.

Investment by private U.S. sponsors is only about $100 million for each project. Foreign investment interest is limited to the one plant on which both the Federal Republic of Germany and Japan are each expected to contribute 25 percent of the project cost.

Should the problems of the H-Coal project be repeated on these large scale demonstration plants, the cost could be enormous. DOE has told GAO that it has taken steps in planning for these two projects to avoid past pitfalls. DOE should be concerned, however, about the small percentage of private investment by U.S. sponsors. It should also be concerned about concurrency in the design and construction schedules. (See pp. 40 to 43.)

Another concern is the risk involved in scaling-up from 50 tons a day (largest Solvent Refined Coal pilot plant) to 6,000 tons a day commercial-sized modules. The H-Coal and Exxon Donor Solvent developers believe the normal progression in process development is to make commercial decisions based on the successful operation of plants processing about 250 to 600 tons a day. (See p. 44.)

AGENCY AND CONTRACTORS COMMENTS

This report was reviewed by DOE and contractors who were affected by statements in the report. DOE was not in total agreement and stated that the report contained statements which were in

error or could be misinterpreted. Meetings with DOE officials resolved these issues. DOE stated the report accurately identifies and describes the problem areas and, in that sense, is quite useful. However, the draft report did not consider DOE's actions to mitigate many of the noted problems. DOE stated that recently completed actions, utilizing lessons learned on past and present projects, should assure better direction and management of these projects. One contractor generally agreed with the report. Another disagreed and provided specific comments on 10 issues. GAO generally disagrees with this contractor's comments because no persuasive evidence was presented.

DOE and contractor comments in their entirety and GAO notes relating to them are in appendixes I through IV.

CONCLUSIONS

GAO's review of the H-Coal and Exxon projects showed inadequacies in DOE's contracting practices and a failure by DOE to properly plan, manage, and monitor, especially the H-Coal project.

The initial Government-industry H-Coal agreements regarding the level of investment by private sponsors and the ceilings imposed on sharing in cost growth were imbalanced. Larger investments by private sponsors and sharing of cost growth provides an incentive to private sponsors to control costs and helps to assure that each party is fully committed to the success of the project.

DOE started the H-Coal project prematurely before sufficiently detailed designs were available and without adequate project planning for functions such as construction scheduling, materials handling, inventory systems, and quality control. DOE staffing was inadequate at both projects to effectively monitor progress and contribute to timely decisions. Its contracts for the H-Coal plants were poorly written and administered.

DOE plans for the two large demonstration plants need careful review and attention in light of escalating cost and the risks involved in scaling up to the 6,000-ton-a-day facilities.

The projected costs together with such others as economics, environmental considerations, and chances of commercial success are key factors in deciding if both processes warrant support in view of competing technologies.

RECOMMENDATIONS TO THE SECRETARY OF DOE

The Secretary of DOE should:

--Assure that projects are properly planned and designed sufficiently before they are started to avoid disruptions and to hold design changes to a minimum.

--Provide adequate DOE support staff to monitor the various phases of its projects and to assure that management tasks such as property control, inventories, subcontracting, and so forth, assigned to private industry are done within regulations and with adequate management controls.

--Establish a format for existing monthly project reports (prepared by contractors) to provide data needed by DOE to effectively monitor the projects.

--Encourage the use of fixed-price contracts when it becomes practical for the contractors to define their remaining efforts and quantities required.

To enhance the prospects for successful future commercialization and lessen the Government's financial burden, the Secretary of DOE should obtain a more equitable cost sharing commitment from private sponsors for all phases of energy projects to assure they share in the risks and fully apply their expertise toward assuring sound management, including adequate controls over cost and schedule.

The Secretary of DOE should also provide to the Congress an assessment of the effect that the escalating costs of the Solvent Refined Coal plants and the risks involved in scaling up to the 6,000-ton-a-day facilities, along with other relevant factors, will have on the feasibility and affordability of both projects and the ability of DOE to reach its program objectives.

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ABBREVIATIONS

DCAA	Defense Contract Audit Agency
DOE	Department of Energy
EDS	Exxon Donor Solvent
GAO	General Accounting Office
SRC	Solvent Refined Coal